

Interactive comment on “Increased cloud activation potential of secondary organic aerosol for atmospheric mass loadings” by S. M. King et al.

A. Laaksonen

ari.laaksonen@uku.fi

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This is an interesting manuscript, clearly worthy of publication in ACP. However, I believe that the optimization with respect to surface tension has not been carried out in a thermodynamically consistent way, and the authors should redo the exercise for the final paper. A 10% reduction of surface tension at the critical size means that the organics in the droplet are quite surface active, and will be highly concentrated in the surface layer. At the same time, they are depleted from the bulk of the droplet, which causes the Raoult term to become smaller, counteracting the surface tension influence on critical supersaturation. This "surface partitioning" effect, which follows from Gibbs'

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surface thermodynamics and finite size of the droplet, has been discussed in a number of recent papers (see list below). Lab experiments (Sorjamaa et al., Prisle et al.) have provided strong evidence that the effect is real.

I would also like to point out that Duplissy et al. (see supplement) carried out somewhat similar sensitivity analysis as has been done in the present ms, by altering surface tension (taking account of surface partitioning), molar volume of the organic, and water activity coefficient. A comparison might be worthwhile.

As a minor point: there are no page limitations in ACP, why is a separate supplement needed?

Sorjamaa R. et al., ACP 4, 2107 (2004)

Sorjamaa R. and Laaksonen A., J. Aerosol Sci. 37, 1730 (2006)

Kokkola H. et al., GRL 33, L10816 (2006)

Topping D.O. et al., ACP 7, 2371 (2007)

Prisle N. et al., Tellus 60B, 416 (2008)

Duplissy J. Et al, GRL 35, L03818 (2008)

Wex H. et al., J Atmos. Sci. 65, 4004 (2008)

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